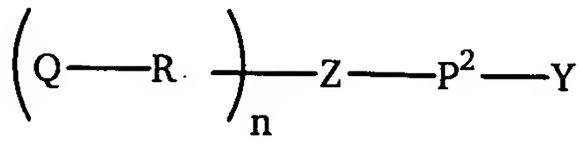
Claims:

1. A multi-functional polymer defined by the formula



where $(Q\text{-}R)_n$ is a functionality cluster, Q is a functional group, R is a multi-valent organic group, P^2 is a long-chain polymer, n is an integer from about 2 to about 10, Y is a proton, a weak functional group, or a selective functional group, and Z is a branch point where the functionality clusters join the long-chain polymer.

2. The multi-functional polymer of claim 1, where each multi-valent organic group R is a polymer.

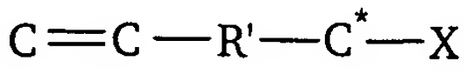
3. The multi-functional polymer of claim 2, where each polymer R has an entanglement length that is greater than about 0.05 of the entanglement length of the polymer and less than about 1.5 of the entanglement length of the polymer.

4. The multi-functional polymer of claim 2, where each polymer R has an entanglement length that is greater than about 0.1 of the entanglement length of the polymer and less than about 1.0 of the entanglement length of the polymer.

5. The multi-functional polymer of claim 2, where each polymer R has an entanglement length that is greater than about 0.2 of the entanglement length of the polymer and less than about 0.7 of the entanglement length of the polymer.

6. A process for preparing a multi-functional polymer comprising the steps of:

preparing a multi-functional macroinitiator by reacting a short-chain living polymer with a molar deficiency of a macroinitiator linking agent defined by the formula



where X is a leaving group, C^* is a carbon atom susceptible to nucleophilic attack, and R is an organic group that will impact the double bond in a manner that will allow the double bond to be anionically polymerized; and

polymerizing monomer with the multi-functional macroinitiator.

7. The process of claim 6, where the molar deficiency includes from about 0.55 to about 0.95 moles of macroinitiator linking agent per mole of short-chain living polymer.

8. The process of claim 6, where the macroinitiator linking agent is vinylbenzyl chloride.

9. The process of claim 6, where the short-chain living polymer has a weight average molecular weight of about 500 to about 10,000.

10. The process of claim 6, where the monomer is conjugated diene monomer.

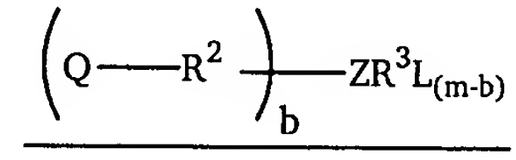
11. The process of claim 10, where the monomer further includes styrene.

12. A process for preparing a multi-functional polymer comprising the steps of:

preparing a multi-functional macroterminator by reacting a short-chain functionalized living polymer with a macroterminator linking agent; and

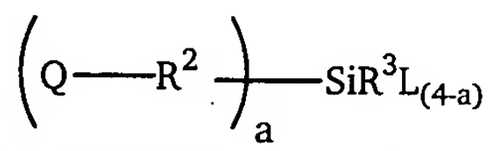
terminating a living polymer with the multi-functional macroterminator.

13. The process of claim 12, where the macroterminator linking agent is defined by the formula



where Z is a branch point, Q is a functional group, R^2 is an covalent bond or organic group, L is a leaving group, R^3 is a multi-valent organic group, m is an integer that is equal to the valency of Z, and b is an integer from 2 to m-1.

14. The process of claim 12, where the macroterminator linking agent is defined by the formula



where Q is a functional group, R^2 is an a covalent bond or organic group, a is an integer of 2 to 3, R^2 is a multi-valent or an organic group, and A is a leaving group.

15. The process of claim 13, where the short-chain living polymer has a weight average molecular weight of about 500 to about 10,000.

16. The process of claim 14, where the short-chain living polymer has a weight average molecular weight of about 500 to about 10,000.

17. A process for preparing a multi-functional polymer comprising the steps of:

preparing a polymer containing a leaving group cluster by reacting a living polymer with a multi-functional terminating agent;

subsequently reacting a polymer containing a leaving group cluster with a short-chain functionalized living polymer.

18. A process for preparing a multi-functional polymer comprising the steps of:

polymerizing a hetero block at the head or tail of a rubbery polymer, where the hetero block is prepared by polymerizing functional macromonomer, where the functional macromonomer is a macromolecule that includes a double bond capable of being anionically polymerized, a functional group, and an organic group

between the double bond and the functional group where the distance between the double bond and the functional group is less than one entanglement length.

19. A method for decreasing hysteresis loss of rubber vulcanizates without deleteriously impacting the processability of the rubber composition that yields the vulcanizate, the method comprising:

employing a multi-functional rubbery polymer in the rubber composition, where the multi-functional polymer includes at least two functional groups at one end of the polymer chain and the opposite end of the polymer is devoid of a functional group or includes a weak functional group or functional group that is selectively functional.